
Aircraft — Ground-based de-icing/anti-icing methods with fluids

Aéronefs — Méthodes de dégivrage/d'antigivrage au sol à l'aide de liquides

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Published in Switzerland

Contents

Page

Foreword.....	v
Introduction	vi
1 Scope	1
2 Normative references	1
3 Terms and definitions.....	2
4 Symbols and abbreviated terms	5
5 General requirements.....	5
6 Quality assurance programme	6
7 Requirements for staff training and qualifications	6
7.1 Personnel qualifications	6
7.2 Training for crews.....	7
7.3 Subjects to be covered in training	7
7.4 Records.....	7
8 Requirements for fluid handling	8
8.1 Environment	8
8.2 Fluid acceptance.....	8
8.3 Mixing of different products	12
8.4 Storage.....	13
8.5 Pumping.....	13
8.6 Transfer lines.....	13
8.7 Heating	13
8.8 Application	14
9 Contamination check.....	14
10 Procedures	14
10.1 Need for de-icing/anti-icing	14
10.2 De-icing.....	14
10.3 Anti-icing	17
10.4 Local frost prevention in cold-soaked wing areas	18
11 Limits and precautions.....	19
11.1 Fluid-related limits	19
11.2 Aircraft-related limits.....	20
11.3 Procedure precautions.....	20
11.4 Clear-ice precautions	22
12 General aircraft requirements after de-icing/anti-icing.....	22
12.1 General.....	22
12.2 Wing, tail and control surfaces	22
12.3 Pitot heads and static ports.....	22
12.4 Engines	23
12.5 Air-conditioning inlets and exits	23
12.6 Landing gear and landing-gear doors	23
12.7 Fuel-tank vents.....	23
12.8 Fuselage	23
12.9 Flight-control check.....	23
12.10 Dried-fluid residues when the aircraft has not been flown after anti-icing	23
12.11 Special maintenance considerations.....	23

13	Post-de-icing/anti-icing-treatment check	23
14	Pre-take-off check and pre-take-off contamination check.....	24
14.1	Pre-take-off check	24
14.2	Pre-take-off contamination check	24
15	Communication procedures	24
15.1	De-icing/anti-icing operation.....	24
15.2	Anti-icing code	24
15.3	Post-treatment check and transmission of the anti-icing code to the pilot-in-command	25
15.4	All-clear signal.....	25
15.5	Emergency procedures	25
15.6	Aircraft movement	25
16	Off-gate de-icing/anti-icing procedures	25
16.1	Communications	25
16.2	Taxi guidance	26
16.3	General instructions	26
16.4	Responsibilities.....	26
16.5	Terminology.....	26
17	Holdover time	26
Annex A	(normative) Guidelines for the application of, and example of holdover times anticipated for, ISO type I fluid/water mixtures.....	28
Annex B	(normative) Guidelines for the application of, and example of holdover times anticipated for, ISO type II, type III and type IV fluid/water mixtures.....	30
Bibliography	32

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 11076 was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 9, *Air cargo and ground equipment*.

This fourth edition cancels and replaces the third edition (ISO 11076:2000), which has been technically revised.

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Introduction

Annexes A and B of this International Standard provide guidelines for the application of different types of de-icing/anti-icing fluids as a function of outside air temperature and of weather conditions. These data require frequent updating. ISO/TC 20/SC 9 has agreed to delegating this task under its own guidance to the Association of European Airlines (AEA) and the Society of Automotive Engineers (SAE), which are organizations recognized as experts in the field of de-icing/anti-icing aircraft on the ground.

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Aircraft — Ground-based de-icing/anti-icing methods with fluids

1 Scope

This International Standard establishes the minimum requirements for aircraft de-icing/anti-icing methods on the ground, in accordance with the ICAO *Manual of aircraft ground de-icing/anti-icing operations* (Doc. 9640-AN/940) and relevant national regulations, to facilitate the safe operation of transport aircraft during icing conditions. This International Standard does not specify requirements for specific aircraft model types.

Aircraft manufacturers' published manuals, procedures or methods take precedence over the information in this International standard.

Airlines' published manuals, procedures or methods supplement the information contained in this International Standard.

Frost, ice or snow deposits, which can seriously affect the aerodynamic performance and/or controllability of an aircraft, are effectively removed by the application of the procedures specified in this International Standard.

De-icing/anti-icing by mechanical means is not covered by this International Standard.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 9001:2000, *Quality management systems — Requirements*

ISO 11075, *Aircraft de-icing/anti-icing fluids — ISO type I*

ISO 11077, *Aerospace — Self-propelled de-icing/anti-icing vehicles — Functional requirements*

ISO 11078, *Aircraft — De-icing/anti-icing fluids — ISO types II, III and IV*

ICAO doc 9640-AN/940 ¹⁾, *Manual of aircraft ground de-icing/anti-icing operations*

JAR-OPS 1.035 ²⁾, *Quality system*

JAR-OPS 1.345 and ACJ 1.345 ²⁾, *Ice and other contaminants, ground procedures*

FAR ³⁾ Title 14 CFR Part 121, paragraph 121.629, *Operation in icing conditions*

1) Available from ICAO (International Civil Aviation Organization), 999 University Street, Montreal, Canada. Phone: +1-514-954-8022 or e-mail: sales_unit@icao.int.

2) Available from JAA (Joint Aviation Authorities, Europe), P.O.Box 3000, 2130 KA Hoofddorp, The Netherlands.

3) Available from FAA (Federal Aviation Administration), USA. Website: <http://www.faa.gov/>, choose "regulations".

FAA Advisory Circular AC 120-60 ⁴⁾, *Ground de-icing and anti-icing program*

CAR ⁵⁾ (Canadian Aviation Regulation), Part VI, Subpart 2, Operating and flight rules, item 602.11, Aircraft icing

CAR ⁵⁾ (Canadian Aviation Regulation), Standard 622.11, Ground icing operations

FAA Advisory Circular AC 120-59 ⁴⁾, *Air carriers internal evaluation programs*

SAE AIR9968 ⁶⁾, *Viscosity Test of Thickened Aircraft Deicing/Anti-Icing Fluids*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

active frost

condition when frost is forming

NOTE Active frost occurs when aircraft surface temperature is ≤ 0 °C (32 °F) and \leq dew point.

3.2

anti-icing

precautionary procedure which provides protection against the formation of frost or ice and accumulation of snow or slush on treated surfaces of the aircraft for a limited period of time (holdover time)

3.3

anti-icing fluid (a)

ISO type I fluid, in accordance with ISO 11075, heated to 60 °C minimum at the spray nozzle

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3.4

anti-icing fluid (b)

mixture of water and ISO type I fluid, heated to 60 °C minimum at the spray nozzle

3.5

anti-icing fluid (c)

ISO type II, III or IV fluids in accordance with ISO 11078

3.6

anti-icing fluid (d)

mixture of water and ISO type II, III or IV fluids

NOTE Anti-icing fluids types II, III and IV are normally applied unheated on clean aircraft surfaces but may be applied heated.

3.7

check

examination of an item against a relevant standard by a trained and qualified person

4) Available from FAA (Federal Aviation Administration, USA).

Website: http://www.faa.gov/library/manuals/examiners_inspectors/8400/fsat/

5) Available from Transport Canada. Website: <http://www.tc.gc.ca/civilaviation>.

6) Available from SAE (Society of Automotive Engineers) Int'l, 400 Commonwealth Drive, Warrendale, PA 15096-0001, USA. Website: <http://www.sae.org/>.

3.8**clear ice**

layer of pure, transparent, homogeneous, hard and smooth ice bonded to a surface

3.9**cold-soaked wing**

condition of the wings of aircraft when they have (partly) a very low temperature due to very cold fuel (below 0 °C) in the wing tanks

NOTE This condition can result from having just landed after a flight at high altitude or from having been refuelled with very cold fuel. The following factors contribute to cold-soaking: temperature and quantity of fuel in fuel tanks, type and location of fuel cells, length of time at high altitude, temperature of refuelling fuel and time since refuelling.

3.10**contamination**

all forms of frozen or semi-frozen moisture such as frost, snow, ice or slush

3.11**contamination check**

check of aircraft surfaces for contamination to establish the need for de-icing

3.12**de-icing**

procedure by which frost, ice, slush or snow is removed from an aircraft in order to provide clean surfaces

3.13**de-icing/anti-icing**

combination of the de-icing and anti-icing procedures

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NOTE It may be performed in one or two steps.

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3.14**de-icing fluid (a)**

heated water

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3.15**de-icing fluid (b)**

ISO type I fluid in accordance with ISO 11075

3.16**de-icing fluid (c)**

mixture of water and ISO type I fluid

3.17**de-icing fluid (d)**

ISO type II, III or IV fluids in accordance with ISO 11078

3.18**de-icing fluid (e)**

mixture of water and ISO type II, III or IV fluids

NOTE De-icing fluid is normally applied heated in order to assure maximum efficiency.

3.19**freezing drizzle**

fairly uniform precipitation composed exclusively of fine drops [diameter less than 0,5 mm (0,02 in)] very close together which freezes upon impact with the ground or other exposed objects

3.20

freezing fog

suspension of numerous minute water droplets which freezes upon impact with ground or other exposed objects

NOTE Freezing fog generally reduces the horizontal visibility at the earth's surface to less than 1 km (0,62 mile).

3.21

frost/hoarfrost

ice crystals that form from ice-saturated air at temperatures below 0 °C (32 °F) by direct sublimation on the ground or other exposed objects

3.22

hail

precipitation of small balls or pieces of ice with a diameter ranging from 5 to > 50 mm (0,2 to > 2,0 in.) falling either separately or agglomerated

3.23

holdover time

estimated time for which an anti-icing fluid will prevent the formation of frost or ice and the accumulation of snow on the protected surfaces of an aircraft, under weather conditions as specified in the holdover time guidelines

NOTE See annexes.

3.24

ice pellets

precipitation of transparent (grains of ice), or translucent (small hail) pellets of ice, which are spherical or irregular, and which have a diameter of 5 mm (0,2 in.) or less

NOTE The pellets of ice usually bounce when hitting hard ground.

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3.25

light freezing rain

precipitation of liquid water particles, which freezes upon impact with the ground or other exposed objects, either in the form of drops of more than 0,5 mm (0,02 in) or smaller drops which, in contrast to drizzle, are widely separated

NOTE Measured intensity of liquid water particles is up to 2,5 mm/h (0,10 in/h) or 25 g/dm²/h with a maximum of 0,25 mm (0,010 in) in 6 min.

3.26

local frost build-up

limited formation of frost in local wing areas sub-cooled by cold fuel or large masses of cold metal

NOTE This type of frost does not cover the entire wing.

3.27

moderate and heavy freezing rain

precipitation of liquid water particles, either in the form of drops of more than 0,5 mm (0,02 inch) or smaller drops which (in contrast to drizzle) are widely separated, which freezes upon impact with the ground

NOTE Measured intensity of liquid water particles is more than 2,5 mm/h (0,10 in/h) or 25 g/dm²/h.

3.28

operator

“AOC-holder” (Air Operator Certificate holder) in accordance with civil aviation regulations

3.29

rain or high humidity (on cold-soaked wing)

water forming ice or frost on the wing surface, when the temperature of the aircraft wing surface is at or below 0 °C (32 °F)

3.30**rain and snow (mixture)**

precipitation in the form of a mixture of rain and snow

3.31**slush**

snow or ice that has been reduced to a soft watery mixture

3.32**snow**

precipitation of ice crystals, most of which are branched, star-shaped or mixed with unbranched crystals

NOTE At temperatures higher than $-5\text{ }^{\circ}\text{C}$ ($23\text{ }^{\circ}\text{F}$), the crystals are generally agglomerated into snowflakes.

3.33**snow grains**

precipitation of very small white and opaque particles of ice that are fairly flat or elongated with a diameter of less than 1 mm (0,04 in)

NOTE 1 When snow grains hit hard ground, they do not bounce or shatter.

NOTE 2 For holdover-time purposes, treat snow grains as snow.

3.34**snow pellets**

precipitation of white, opaque particles of ice, round or sometimes conical, with a diameter range from about 2 mm to 5 mm (0,08 in to 0,2 in)

NOTE Snow pellets are brittle, easily crushed; they bounce and may break on hard ground.

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4 Symbols and abbreviated terms

OAT outside air temperature

FP freezing point

5 General requirements

Aircraft ground de-icing/anti-icing methods shall comply with this International Standard, the ICAO *Manual of aircraft ground de-icing/anti-icing operations* (Doc. 9640-AN/940), the applicable national civil aviation regulations (CAR 602.11 and 622.11, JAR-OPS 1.345 and ACJ 1.345, FAR 14 CFR 121.629 and AC 120-60) and any applicable local rules.

The various local rules concerning aircraft cold-weather operations are very specific and shall be strictly adhered to.

A pilot shall not take off in an aircraft that has:

- a) frost, snow, slush or ice present on any propeller, windscreen or power-plant installation or on airspeed, altimeter, rate of climb or flight-altitude instrument systems;
- b) snow, slush or ice adhering to the wings, stabilizers, control surfaces or fuselage, in gaps between the airframe and control surfaces or in gaps between control surfaces and control tabs, or any frost on the upper surfaces of wings, stabilizers or control surfaces.

For this reason a contamination check of the aircraft surfaces shall be performed prior to departure.

6 Quality assurance programme

Operators shall establish a quality assurance programme to ensure correct de-icing/anti-icing operations at all stations where applicable.

This should be an approved programme which, in addition to the present, takes into account the requirements of carriers' internal evaluation programmes (JAR-OPS 1.035 or FAA AC 120-59) or, for non-airline subcontractors and handling agencies, ISO 9001 or equivalent pertinent standards.

This programme shall include at least:

- a) auditing;
- b) training;
- c) methods and procedures;
- d) training records;
- e) qualification;
- f) publications;
- g) equipment and fluids.

The auditing of all parts of the de-icing/anti-icing operation is required to check the ongoing conformance with all regulations issued by authorities, operators, manufacturers and handling agents.

Training of all personnel involved in the de-icing/anti-icing operation is required to ensure the correct performance of all tasks which have to be fulfilled. [ISO 11076:2006](https://standards.iteh.ai/catalog/standards/sist/32751ab5-c209-47aa-a8ad-120000000000/iso-11076-2006)

Methods and procedures shall be defined to allow the clear and safe accomplishment of all tasks that are necessary for de-icing/anti-icing an aircraft.

Training records of all de-icing/anti-icing personnel are required to guarantee that all requirements in the field of training and skill are fulfilled.

Qualification of all de-icing/anti-icing personnel is required to assure correct performance of all tasks.

Written instructions are required for the aircraft de-icing/anti-icing operation to ensure the correct accomplishment of all tasks.

Equipment and fluids have to be maintained in such a way that the correct quality is assured.

7 Requirements for staff training and qualifications

7.1 Personnel qualifications

De-icing/anti-icing procedures shall be carried out exclusively by personnel trained and qualified in this subject.

Companies providing de-icing/anti-icing services shall have both a training/qualification programme and a quality assurance programme to monitor and maintain an acceptable level of competence.

7.2 Training for crews

Both initial and annual recurrent training for flight crews and ground crews shall be conducted to ensure that all such crews obtain and retain a thorough knowledge of aircraft de-icing/anti-icing policies and procedures, including new procedures and lessons learned.

Training success shall be proven by an examination/assessment which shall cover all training subjects listed in 7.3.

The theoretical examination shall be in accordance with the latest local examination rules/requirements. The pass mark shall be 75 % and only persons passing this examination can be qualified.

For personnel performing the actual de-icing/anti-icing treatment on aircraft, practical training with the de-icing/anti-icing equipment shall be included.

7.3 Subjects to be covered in training

Training shall include the following items as a minimum:

- a) effects of frost, ice, slush, snow and fluids on aircraft performance;
- b) basic characteristics of aircraft de-icing/anti-icing fluids, including causes and consequences of fluid degradation and residues;
- c) general techniques for removing deposits of frost, ice, slush and snow from aircraft surfaces and for anti-icing;
- d) de-icing/anti-icing procedures in general and specific measures to be performed on different aircraft types;
- e) types of check required;
- f) de-icing/anti-icing equipment and facilities operating procedures including actual operation;
- g) safety precautions;
- h) emergency procedures;
- i) fluid application and limitations of holdover-time tables;
- j) anti-icing codes and communication procedures;
- k) special provisions and procedures for contract de-icing/anti-icing (if applicable);
- l) environmental considerations, e.g. where to de-ice, spill reporting, hazardous-waste control;
- m) new procedures and development, lessons learned from previous winters.

7.4 Records

Records of personnel training and qualifications shall be maintained for proof of qualification.